

# **EXHIBIT A**

**UNITED STATES DISTRICT COURT  
NORTHERN DISTRICT OF ILLINOIS  
EASTERN DIVISION**

HUNTAIR, INC.

Plaintiff,

**VS.**

CLIMATECRAFT, INC.

Defendant.

Case No. 07 C 6890

Honorable David H. Coar

## PLAINTIFF HUNTAIR, INC.'S PROPOSED CLAIM ELEMENTS FOR CONSTRUCTION

Pursuant to the Court's Scheduling Order entered in this matter, Plaintiff hereby submits its proposed terms and claim elements for construction in the form of jury instructions.

In deciding whether or not the ClimateCraft products infringes the claims of the patent, you must first understand the meaning of the words in the claims. It is my job as Judge to determine what certain terms in the claims mean and to instruct you about their meaning. These definitions are to be used when determining whether the claims are infringed and whether or not the claim is valid.

The meaning of many of the terms in the claim is not in dispute, and you should give those words and phrases their ordinary English language meaning.

**I. U.S. PATENT NO. 7,179,046**

1. The term “fan array” means “two or more fan units arranged in a grid, a spaced pattern, a checkerboard, rows slightly offset, columns slightly offset, or a staggered array configuration”.

2. The term "air handling compartment" means "the inlet plenum, fan section and discharge plenum".

3. The term "a control system for operating said plurality of fan units at substantially peak efficiency by strategically turning on and off selective ones of said plurality of fan units" means "a system, subject to manual or automatic control, for operating the fan units at nearly peak efficiency by strategically turning on and off selective ones of the fan units."

4. The term "a control system for controlling said plurality of fan units, said control system allowing control of the speed of the fan units in said plurality of such that they run at substantially peak efficiency" means "a system, subject to manual or automatic control, for controlling the speed of the fan units so that they run at nearly peak efficiency."

## **II. U.S. PATENT NO. 7,137,775**


1. The term "fan array" means "two or more fan units arranged in a grid, a spaced pattern, a checkerboard, rows slightly offset, columns slightly offset, or a staggered array configuration".

2. The term "air handling compartment" means "the inlet plenum, fan section and discharge plenum".

3. The term "array controller for controlling said at least six fan units to run at substantially peak efficiency" means "an automatic system that operates the at least six fan units at nearly peak efficiency".

Respectfully submitted,

Dated: May 27, 2008

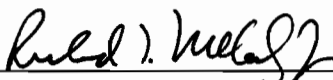
By:   
David T. Pritikin  
Richard T. McCaulley Jr.  
Stephanie P. Koh  
SIDLEY AUSTIN LLP  
One South Dearborn  
Chicago, IL 60603  
Telephone: 312-853-7000  
Facsimile: 312-853-7036

*Attorneys for Plaintiff Huntair, Inc.*

**CERTIFICATE OF SERVICE**

I hereby certify that on this 25th day of February, 2008, a true and correct copy of the foregoing document, HUNTAIR, INC.'S OBJECTIONS AND RESPONSES TO CLIMATECRAFT'S FIRST SET OF REQUESTS FOR THE PRODUCTION OF DOCUMENTS (NOS. 1-115), was served via United States Mail, postage prepaid, to the following counsel for Defendant ClimateCraft, Inc.:

Charles C. Kinne  
1240 Iroquois Ave.; Suite 204  
Naperville, Illinois 60563

  
\_\_\_\_\_  
Richard T. McCaulley Jr.

## **EXHIBIT B**

# ***KINNE IP GROUP***

## ***Intellectual Property Law***

**PATENT, TRADEMARK, COPYRIGHT AND TRADE SECRET  
LITIGATION, PROCUREMENT AND COUNSELING**

1240 Iroquois Ave.

Suite 204

Naperville, Illinois 60563

ph (630) 904-0940

fax (888) 887-7158

[www.kinnelaw.com](http://www.kinnelaw.com)

May 27, 2008

***Via Federal Express***

Richard T. McCaulley, Jr., Esq.  
Sidley Austin LLP  
1 South Dearborn St.  
Chicago, IL 60603

**Re: Huntair, Inc. v. ClimateCraft, Inc., C.A. No. 07 C 6890**

Dear Rick:

As we discussed, the Court requires the parties to exchange their respective claim terms for construction and the proposed jury instruction the party would have the Court give. You asked that we extend the May 22 deadline until today, and I agreed.

ClimateCraft contends that some of the terms in the patent claims are not amendable to construction and insolubly ambiguous. For some of these, no jury instruction is offered, although ClimateCraft reserves the right to offer one in response to Huntair's position and as discovery progresses. For others, proposed jury instructions are offered in the alternative, should the Court decline to find the claim term indefinite. Thus, terms including, but not limited to, "fan array," "array controller for controlling ... fan units to run at substantially peak efficiency by strategically turning selective ones of said ... fan units on and off," "peak efficiency," "substantially peak efficiency," "reduced efficiency," "strategically," "peak efficiency operating range," "a control system for operating said plurality of fan units at substantially peak efficiency," "programmable array controller," and "acoustically absorptive insulation surface" may be indefinite.

The following are ClimateCraft's initial, proposed terms for construction and corresponding, proposed jury instructions.

Richard T. McCaulley, Jr., Esq.

May 27, 2008

Page 2

“fan array” – two or more fan units positioned to work together in parallel

“array controller” – an control mechanism operating an array

“programmable array controller” - an array controller having a computer that can be programmed to provide an automatic control mechanism operating an array to achieve a desired result

“air handling compartment” – a portion of an air handler or air handling system

“air handler” or “air handling system” - a system having components designed to work together to condition air as part of the primary system for ventilation of structures

“peak efficiency” – the maximum achievable static efficiency for a fan unit

“airway path” - the combined discharge plenum and inlet plenum

“fan array configuration” - the pattern created by the fan units in a fan array

“fan unit chamber” - a housing containing a fan unit

“air relief passage therebelow” - space provided below a fan unit within a fan unit chamber

“grid system” - system providing a framework for installation of fan units

“fan wheel diameter” – the distance from one side of the outer periphery of a fan wheel to the opposite side of the outer periphery of the fan wheel

“backdraft dampeners” - apparatus that blocks airflow through a fan unit when the fan unit is turned off to prevent reverse air flow through that fan unit

“an array controller for controlling said at least six fan units to run at substantially peak efficiency by strategically turning selective ones of said at least six fan units on and off” – for use with at least six fan units, a control mechanism controlling the fan units to run at substantially peak efficiency by (a) automatically determining whether at least one, but not all, of the fan units should be turned off and the remaining fan units should be run at substantially peak efficiency, (b) automatically turning off the at least one fan unit in accordance with the determination made above and (c) automatically running the remaining fan units at substantially peak efficiency.

“a control system for operating said plurality of fan units at substantially peak efficiency by strategically turning on and off selective ones of said plurality of fan units” – a control system operating the fan units to run at substantially peak efficiency by (a) automatically determining whether at least one, but not all, of the fan units should be turned off and the remaining fan units should be run at substantially peak efficiency, (b)

Richard T. McCaulley, Jr., Esq.

May 27, 2008

Page 3

automatically turning off the at least one fan unit in accordance with the determination made above and (c) automatically running the remaining fan units at substantially peak efficiency.

“a control system for controlling said plurality of fan units, said control system allowing control of the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency” – a control system controlling the fan units and permitting operation of the fan units at substantially peak efficiency by permitting an unspecified component, which may be the control system, to (a) automatically determine whether at least one, but not all, of the fan units should have its speed reduced and the remaining fan units should be run at a greater speed to run at substantially peak efficiency, (b) automatically reducing the speed of the at least one fan unit in accordance with the determination made above and (c) automatically running the remaining fan units at a greater speed to run at substantially peak efficiency.

“a control system for controlling the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency” – a control system controlling the fan units to run at substantially peak efficiency by (a) automatically determining whether at least one, but not all, of the fan units should have its speed reduced and the remaining fan units should be run at a greater speed to run at substantially peak efficiency, (b) automatically reducing the speed of the at least one fan unit in accordance with the determination made above and (c) automatically running the remaining fan units at a greater speed to run at substantially peak efficiency.

ClimateCraft further reserves the right to offer proposed jury instructions and contentions to the Court regarding other claim terms, as necessary, after receiving Huntair’s proposed terms for construction and as discovery progresses overall.

We look forward to reviewing Huntair’s claim terms and contentions and working with you in an effort to reach agreement, where possible, on as many terms as possible.

Respectfully yours,

A handwritten signature in cursive script, appearing to read "Charlie".

Charles C. Kinne

CCK/pc



# **EXHIBIT C**

## FAN ARRAY CLAIM CONSTRUCTION REPORT

1. I, Albert V. Karvelis, have been asked by counsel for Huntair, Inc. (“Huntair”) to analyze claim construction issues related to terms from the Claims of U.S. Patent Nos. 7,179,046 and 7,137,775 (‘046 Patent” and ‘775 Patent”). This report sets forth my opinions and bases for those opinions concerning claim construction. I expect that I will offer additional opinions in this matter according to the timetable set for expert discovery by Judge Coar. The opinions I set forth herein are my own and are based on my research in this matter and the education, experience, training and skill I have accumulated in the course of my 40 year career in engineering. Between now and such a time that I may be asked to testify, I expect to continue my review, evaluation and analysis of information generated during discovery, as well as of relevant evidence presented at trial.

### QUALIFICATIONS

2. I, Albert V. Karvelis, Ph.D., P.E., am a licensed Professional Engineer in Illinois, Texas, Connecticut, Michigan, Wisconsin and Florida with over 40 years of engineering experience. I am currently employed by Packer Engineering, Inc. (“Packer”) in Naperville, Illinois, as Senior Vice President. I joined Packer in 1989. Packer is a multidisciplinary engineering and scientific consulting and technical services company. My responsibilities with Packer include mechanical engineering consulting and testing with respect to machinery design and performance, manufacturing processes, and failure analysis in addition to various management duties.

3. I am an active member of the American Society of Mechanical Engineers in the Design Engineering Division and the Codes & Standards Division for over 25 years. A copy of my *curriculum vitae* is attached as Appendix A. A list of cases in which I have testified at deposition or trial during the last four years is attached as Appendix B.

4. In 1966, I received my bachelor’s degree in Aerospace Engineering from the University of Michigan. In 1967, I received my master’s degree in Engineering, also from the University of Michigan. I accepted a faculty position in the Mechanical Engineering Department at the Pennsylvania State University. In 1975, I received my doctorate in Engineering Acoustics from the Pennsylvania State University.

5. From May 1975 to January 1989, I was employed by the Trane Company, Babcock & Wilcox and Borg Warner as engineer and manager. I am familiar with mechanical design and patent matters as a result of my activities at the University of Michigan Institute of Science & Technology, U.S. Navy, Trane, Babcock & Wilcox, Borg Warner and Packer Engineering. I was originally trained in patent analysis while serving on active duty in the US Navy with the Office of Naval Research.

6. The subject technology of the patents-in-suit is HVAC equipment design and performance. The specific HVAC equipment that is the subject of the asserted patents is: air handling systems or “air handlers.” I have significant engineering experience with Heating Ventilating and Air Conditioning (HVAC) equipment design and performance. The experience includes component design and test for Trane Company and York International, the two of the

three leading HVAC manufacturers in the USA. I have also conducted failure analysis of hospital, hotel and dormitory and tunnel air handling equipment while at Packer Engineering. I am a person of at least ordinary skill in the art.

7. In the course of my research, I have studied the patents-in-suit, portions of their prosecution history, Plaintiff's Preliminary Infringement Contentions disclosure, and Webster's Third New International Dictionary of the English Language, Unabridged (2002).

8. I am a salaried employee of Packer Engineering. Packer Engineering charges an hourly rate of \$350 for my time, plus reasonable expenses.

### **CLAIM CONSTRUCTION**

9. I reviewed the asserted claims of the '046 and '775 Patents. I find that the claim terms are readily understood by a person of ordinary skill in the art of designing air handling systems for conditioning the air of structures. I have reviewed the claim construction positions offered by ClimateCraft, and find that they have incorporated many extraneous limitations into the claims.

10. The term "fan array" in the context of the '046 and '775 Patents means a "plurality of fan units arranged in a grid, a spaced pattern, a checkerboard, rows slightly offset, or a staggered array configuration."

11. The term "air handling compartment" means "the inlet plenum, fan section and discharge plenum." The patent terminology is consistent with the ordinary and customary usage of the term "air handling compartment." I will also provide definition of the term "plenum" as used in the art, if requested.

12. The term "a control system for operating said plurality of fan units at substantially peak efficiency by strategically turning on and off selective ones of said plurality of fan units" means: "operating the fan units at nearly peak efficiency by strategically turning on and off selective ones of the fan units by using a manual or automatic control."

13. The term "a control system for operating said plurality of fan units, said control system allowing control of the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency" means: "operating the fan units at speeds achieving nearly peak efficiency by using a manual or automatic control."

14. In my opinion, a person of ordinary skill in the art would readily understand that there are at least two strategies for "turning on and off" individual fans driven by electric motors as practiced in the HVAC art: manual operation and automatic/programmable controllers. Claims depending from the independent claim specifically limit the dependent claim to the programmable controllers. Similarly, the speed of individual fans, singly or collectively, may also be set either manually or automatic/programmable means. In my opinion, a person of ordinary skill in the art would understand that the claim term "control system for..." is meant to be broad and to include manual as well as automatic/programmable control strategies in the context of the asserted patents.

15. I have also reviewed the position submitted by ClimateCraft. The ClimateCraft definition requires, among other things, automatically determining if fans should be turned off, and automatically turning off fans. ClimateCraft consistently inserts the term “automatic” in all their proposed claim constructions for “control system” which sets either speed or on/off state. There is no such limiting requirement in the claims of the ‘046 Patent that refer to a “control system.” There are claims in the patent which are directed to a preferred embodiment where the fan array is under automatic control (see the discussion regarding the programmable array controller below), but the “control system” contains no such limitation or requirement. Accepting ClimateCraft’s position results in no substantial difference between an “array controller” and a “control system” as the terms are used in the patents.

16. My understanding is supported by the patents themselves. The specification states that “[f]or example, in the 5x5 fan array such as that shown in FIGS. 5, 13, and 14, **a person** desiring to control the array may select desired air volume, a level of air flow, a pattern of air flow, and/or **how many fans to operate.**” (‘046 Patent, Col. 7, ll. 4-7). The specification also states that “[a] control system (that may include the array controller 300) would be used to take fan units 200 on line (an “ON” fan unit 200) and offline (an “OFF” fan unit 200) individually.”

17. ClimateCraft defines “peak efficiency” as the term is used in the patents to refer to the “maximum achievable static efficiency for a fan unit...” This is not a definition that is consistent with the art, in my opinion. First of all, reference to the 2008 ASHRAE Handbook provides support for the mechanical efficiency as being the more appropriate choice for general fan efficiency and not static efficiency. Second, the ClimateCraft definition implicitly ignores the fact that the mechanical efficiency of a given fan design can be different at different speeds and therefore their construction would therefore make the preferred embodiment specification internally inconsistent. Third, the ASHRAE Handbook makes clear that “the optimum selection range or peak efficiency point is identified in various ways by different manufacturers.” The term “maximum achievable static efficiency” operating point for a fan unit is not a term that is recognizable in the art.

18. The ASHRAE Handbook and the ‘046 specification both discuss in some detail, the issue of surge/instability induced by the use of two fans. The ClimateCraft definition applied to the claims would preclude the adoption of the industry practice of adapting to system and surge effects in the fan array claimed inventions. A person of ordinary skill in the art would understand that that is one more reason for finding the ClimateCraft definition unreasonable and unlikely to be adopted. For at least these above stated reasons, I find the ClimateCraft definitions incorrect.

19. In my opinion, a person of ordinary skill in the art would understand the term “peak efficiency” to mean the “optimizing the ratio of power delivered by the fans to the electrical power consumed by the fans.”

20. ClimateCraft further proposed a construction of the term “a control system for controlling the speed ... peak efficiency” by incorporating requirements that describe the use of automatic determination of which fans speeds should be increased and which should be

decreased. Their construction is completely unjustified because it incorporates a specific and detailed control strategy that is not found in the original claim term.

21. Furthermore, the asserted patents refer to efficiency of the “fan units” each of which is defined as at least the “inlet cone, a fan, and a motor.” (Col. 1, ll. 46-47). The “strategically turning on and off” control claim term does not require that each individual fan unit run at peak static efficiency as proposed by ClimateCraft. A person of ordinary skill in the art, in my opinion, would understand that “strategically turning on and off selective ones [fan units]” cannot result in the “static efficiency” of each of the remaining running fans becoming optimized simply because one or more individual units were turned off or on, as would be required by the proposed by ClimateCraft construction.

22. This further supports my understanding that the efficiency as used in the patents refers to mechanical power efficiency (“[u]sing a control system to take fan units on line and off line allows a user to control **power usage** and/or air flow”).

23. I understand that ClimateCraft may offer an expert witness in support of its claim construction positions. I reserve the right to provide further opinions based on my review of his or her report. If asked, I will prepare and present an overview, to the Court, of the HVAC technology relevant to the determination of proper construction of the disputed claim terms.



---

Albert V. Karvelis

---

June 19, 2008

Date

## **EXHIBIT D**

**UNITED STATES DISTRICT COURT  
NORTHERN DISTRICT OF ILLINOIS  
EASTERN DIVISION**

HUNTAIR, INC.

Plaintiff,

v.

CLIMATECRAFT, INC.

Defendant.

**Civil Action No. 07 C 6890**

**The Honorable David H. Coar**

**Magistrate Judge Morton Denlow**

**EXPERT REPORT AND DECLARATION OF DR. JAMES RICE  
SUBMITTED BY CLIMATECRAFT, INC.**

## **TABLE OF CONTENTS**

I.	Experience And Qualifications .....	1
II.	Background .....	2
III.	Scope of Task.....	2
IV.	The Person Of Ordinary Skill In The Art .....	2
V.	Technical Background .....	4
A.	Fan Types.....	4
B.	Fan Curves .....	4
C.	Fan Laws .....	7
D.	System Resistance.....	7
E.	Fan Efficiency .....	8
F.	The Surge Line.....	13
VI.	Claim Construction Issues .....	15
A.	Embodiments Disclosed in the Hopkins Patents .....	15
B.	Prosecution History of the Hopkins Patent.....	16
C.	Efficiency .....	17
1.	Peak efficiency.....	17
2.	Substantially peak efficiency .....	17
D.	Control, an Array Controller and Control System.....	18
E.	a control system for operating said plurality of fan units at substantially peak efficiency by strategically turning on and off selective ones of said plurality of fan units.....	19
F.	a control system for controlling said plurality of fan units, said control system allowing control of the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency.....	22
G.	a control system for controlling the speed of the fan units in said plurality of fan units	



	such that they run at substantially peak efficiency .....	24
H.	an array controller for controlling said at least six fan units to run at substantially peak efficiency by strategically turning selective ones of said at least six fan units on and off .....	26
VII.	Conclusion .....	28

**EXHIBIT LIST**

EXHIBIT A – Curriculum Vitae of Dr. James Rice

EXHIBIT B – Materials Considered

## **I. EXPERIENCE AND QUALIFICATIONS**

1. I hold Bachelors, Masters and Ph.D. degrees in Mechanical Engineering. I have worked as a consultant or advisor for over 30 companies including Ford Motor Company, Boeing Aircraft, General Motors, and Siemens. I have authored or co-authored over 30 publications, and numerous consulting reports. I have over 30 years of professional experience in mechanical engineering design and analysis in both academic and industrial environments.

2. A current copy of my curriculum vitae setting forth details of my background and relevant experience is attached as Exhibit A. My curriculum vitae include a listing of cases for which I have served as an expert witness over the last four years and a list of publications I have authored. ClimateCraft has retained me in connection with the above captioned litigation. I am compensated at the rate of \$300 per hour. My compensation is not contingent upon the outcome of this litigation.

3. As detailed in my curriculum vitae, I have extensive experience in fluid mechanics in both an academic and industrial environment. This experience includes in particular my participation in the Rotating Machinery and Controls Research Group at the University of Virginia for over five years. My activities in this group were focused on the development of analysis methods for rotating machinery including such applications as the fans in the patents in suit. In addition, during my years with CompuFlo, I was involved in the further development and application of fluid mechanics analysis methods in a commercial environment. These methods have been used in a diverse range of applications including fans such as those in the patents in suit. My more recent consulting activities have also included projects in fluid mechanics for a variety of industrial applications.

4. In support of my testimony, I may use various demonstrative exhibits, including but not limited to, fan performance curves and other performance data for ClimateCraft fan arrays. In addition, I may use blow-ups or electronic versions of the figures included in this report as well as animations or other demonstrative evidence.

## **II. BACKGROUND**

5. Huntair, Inc. (hereinafter “Huntair”) has accused ClimateCraft, Inc. (hereinafter ClimateCraft”) of infringing U.S. Patent No. 7,137,775 (“the ‘775 patent”) and U.S. Patent No. 7,179,046 (“the ‘046 patent”). The ‘046 patent claims priority to the ‘775 patent. The inventor on both of the two patents is Lawrence G. Hopkins and as such I will refer to the two patents collectively as “the Hopkins patents.” Although the specification of the two patents is identical, the claims are somewhat different.

## **III. SCOPE OF TASK**

6. It is my understanding that a Markman hearing is scheduled to address claim construction issues in conjunction with the above captioned litigation. The subject matter of the patents in suit is rather complicated technically and as such the claim terms at issue require some background technical information to assist the Court in arriving at a construction. In the following report I have provided the required background technical information. I have also addressed key claim terms at issue in light of this background information.

7. In developing the following report, I have considered the patents in suit, the provisional patent applications and the PCT application that are referred to in the patents in suit as priority documents, the prior art cited, the prosecution history of each patent, and relevant technical literature. A listing of the materials considered is provided in the attached Exhibit B.

8. At all times in this report, I am providing my opinion as to the understanding of one of ordinary skill in the art as of the 2002-2004 time frame.

## **IV. THE PERSON OF ORDINARY SKILL IN THE ART**

9. Based on my more than 30 years of experience in the field of mechanical engineering and experience with numerous different engineering/manufacturing companies, I

believe the person of ordinary skill in the art related to a “Fan Array Fan Section in Air-Handling Systems” as disclosed in the Hopkins patents would have a level of skill that includes a bachelor’s degree in Mechanical Engineering with at least two years experience in the field or training as a designer and at least several years of experience in the field.

## V. TECHNICAL BACKGROUND

10. The following sections provide a simplified description of the basic operation and design considerations for fans typical of those in the patent in suit.

### A. Fan Types

11. In the applications of interest in the patents in suit there are in general two broad types of fans used, i.e., either axial or centrifugal type fans as illustrated below in Figure 1. Although the performance characteristics of these two types of fans will vary somewhat, the following discussion is applicable in general to both types of fans.

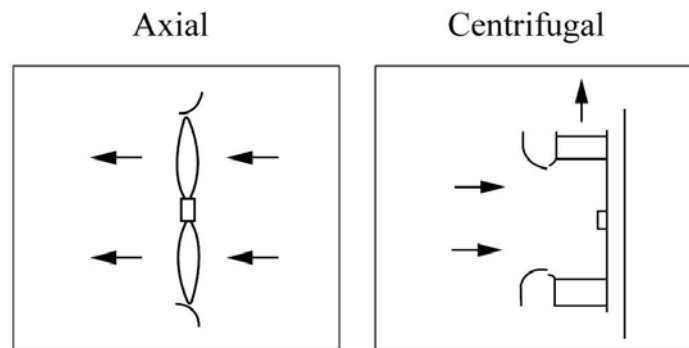


Figure 1. Fan Types<sup>1</sup>

12. The Hopkins patents are directed to an array of fans which includes a plurality of individual fans arranged in matrix configuration. In the following sections, the discussion will focus on individual fan units, but in general the topics discussed may be extended to cover a fan array. Where such an extension is required, the basis of the extension is specifically discussed.

### B. Fan Curves

---

<sup>1</sup> "Fan Performance Characteristics of Centrifugal Fans," Twin City Fan Companies, Ltd., Publication ED-2400.

13. The fan manufacturer will typically provide a “fan curve” or “static pressure curve” which shows the fan performance under a range of operating conditions. These curves show the relationship between the quantity of air a fan will deliver and the static pressure rise generated by the fan at various air quantities. The curves also may also show the required horsepower for a given quantity of flow.

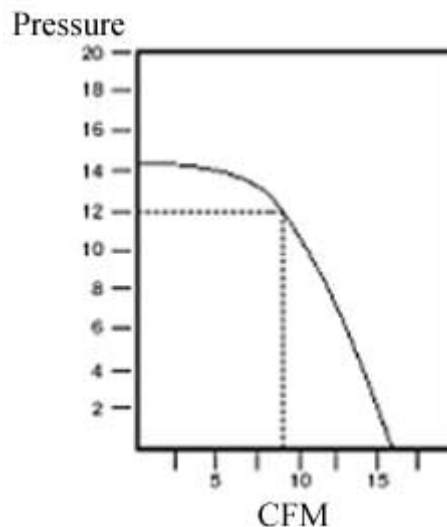


Figure 2. Typical Fan Curve<sup>2</sup>

14. Figure 2 represents the performance for a given fan size, and rotational speed, “RPM.” The flow scale, typically in cubic feet per minute (“CFM”), is presented along the x-axis (horizontal). The pressure rise scale, typically expressed in units of inches of water (“inches W.G.”) is presented along the y-axis (vertical). For example, 10 inches of water is approximately 0.3 pounds per square inch (psi). The shape of this curve will vary with the design of the fan particularly in the low flow region of the curve. The point where the curve intersects the y-axis, the CFM is zero, is often referred to as the “no flow” point. The point where the curve intersects the horizontal axis, the pressure rise is zero, may be referred to with a number of terms such as “wide open volume,” “free delivery,” “free air,” or “wide open performance” point.

<sup>2</sup> “The Basics of Fan Performance Tables, Fan Curves, System Resistance Curves, and Fan Laws. Greenheck Fan Corp.

15. In the design process, the engineer will typically know the required flow rate and pressure rise for a given application. For a particular fan, he will find the required CFM and move vertically to the static pressure curve, read horizontally to the left to determine the pressure rise provided by the fan at that flow rate.

16. Figure 3 shown below illustrates the effects of speed change, RPM, on the fan performance. According to the fan laws described below, the flow rate, CFM, varies directly with the fan speed, RPM. The result of reducing the speed is a similar curve in a lower position. Similarly, increasing the speed will result in a similar curve at a higher position as illustrated in Figure 3.

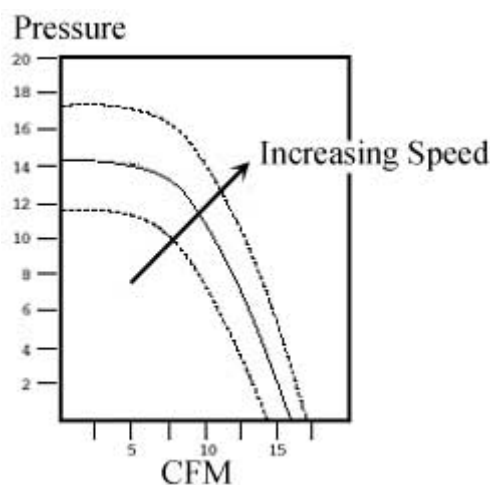


Figure 3. Effect of Fan Speed<sup>3</sup>

17. In addition to the above information shown on the performance graph, the power required to drive the fan at a particular speed may also be shown on the graph as illustrated below in Figure 4. The power required is typically expressed in units of brake horsepower, “BHP.” Figure 4 illustrates the addition of the BHP curve. The power scale is presented along the right y-axis. To determine the power, find the flow rate on the CFM axis and move vertically to the BHP curve. At this intersection, move horizontally to the right-hand scale to read the BHP at that flow.

<sup>3</sup> Ibid.



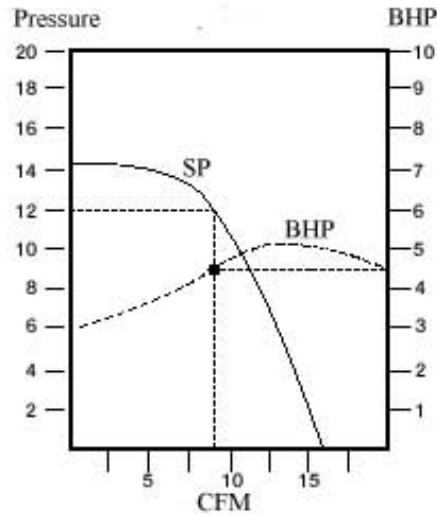


Figure 4. Pressure Rise (SP) and Power Required (BHP)<sup>4</sup>

18. The curve shapes in figures 2-4 are typical of centrifugal fans. Other fan types have both static pressure and power curve shapes that vary somewhat from those shown. However, the principle of reading the curves is the same.

### C. Fan Laws

19. The “Fan laws,” as listed below, are used to relate to the static pressure rise (SP), flow rate (CFM), and power (BHP) with the speed (RPM).

- CFM varies directly with RPM
- SP varies with the square of RPM
- BHP varies with the cube of the RPM

### D. System Resistance

20. In selecting fans, another fundamental aspect is the system resistance. The system includes the overall building duct system and internal components that the fan is providing air flow through. The system resistance curves are a graphical representation of how a system reacts

<sup>4</sup> Ibid.

to a given air flow as illustrated in Figure 5 below. At the operating point, as illustrated in Figure 5, the flow rate and pressure of the fan is in balance with the flow rate and pressure required by the system.

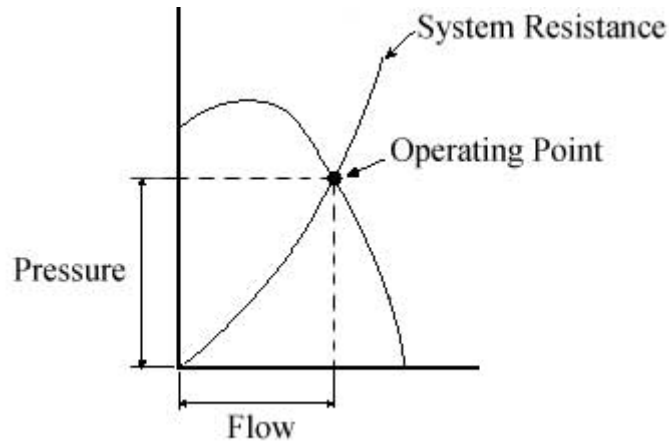


Figure 5. System Resistance<sup>5</sup>

21. The overall system flow resistance is the sum of all the resistances through the duct, all elbows, filters, dampers, coils and any other device that resists flow throughout the system. Figure 5 illustrates that the pressure drop through the system increases approximately as the square of the flow rate.

22. The operating point is the point where the system resistance curve intersects the static pressure curve for the fan. This point is illustrated in Figure 5 above as the “operating point.” As introduced above, at this point the system flow and pressure requirements are in balance with the flow and pressure provided by the fan.

#### **E. Fan Efficiency**

23. The claims of the Hopkins patents refer to the fan efficiency and in particular operating the fans at “substantially peak efficiency.” For this reason, I have presented the

---

<sup>5</sup> Ibid.

following discussion to explain the term efficiency as one of ordinary skill in the art would have understood. Fundamentally, the efficiency of a fan may be defined in words as the following.

$$\text{Fan Efficiency} = \eta = \frac{\text{Power delivered to the air}}{\text{Power required to drive the fan}}$$

24. Because of inherent losses in the process, the power actually delivered to the air will be less than the input power to drive the fan and the efficiency will be less than 1. If we assume the air is incompressible (as explained below), the power delivered to the air is simply the product of the flow rate and the pressure rise across the fan. In consistent units,<sup>6</sup> the fan efficiency is thus given by the following equation.<sup>7</sup>

$$\eta = \frac{Q\Delta P}{H}$$

where

$Q$  = flow rate

$\Delta P$  = pressure rise

$H$  = input power to drive the fan

25. Consistent units in the standard SI system of units would be Pascal for pressure, cubic meters per second for the flow rate, and watts for the power. Designers in the U.S. typically do not work in terms of consistent units and use more convenient units. As a result, the efficiency equation typically used in practice will include a unit conversion factor as illustrated in the following equation for the fan efficiency (again, if we assume the air is incompressible).<sup>8</sup>

---

<sup>6</sup> Consistent units eliminate the need for the inclusion of any unit conversion factors in the basic equations, but the resulting units are quite often unfamiliar and inconvenient. For example, the resulting unit for pressure in the metric system is Pascal which is not commonly used as a unit for pressure.

<sup>7</sup> Laboratory Methods for Testing Fans for Aerodynamic Performance Rating, ANSI/ASHRAE 51-1999, December 2, 1999, p. 16 – 17.

<sup>8</sup> Ibid.

$$\eta = \frac{Q\Delta P}{6362 H}$$

where

$Q$  = flow rate in CFM

$\Delta P$  = pressure rise in inches of water

$H$  = input power to drive the fan in horsepower

26. Note that the input power to drive the fan,  $H$ , may be obtained either by measuring the fan shaft input torque and speed or by using a calibrated motor with a known motor efficiency. In the latter case, the power required to drive the fan may be calculated from the power required to drive the motor using the following equation.

$$H = \eta_M W$$

where

$H$  = input power to drive the fan

$\eta_M$  = motor efficiency

$W$  = input power to the motor

27. The pressure rise across the fan may be expressed in terms of either the static pressure rise or the total pressure rise. The basic efficiency definitions include a “static efficiency” where the efficiency is defined in terms of the static pressure rise and a “total efficiency” where the efficiency is defined in terms of the total pressure rise. The total pressure is simply the sum of the static pressure and the dynamic pressure, which results from the air velocity, as given by the following equation.

$$P_0 = P + \frac{\rho V^2}{2}$$

where

$P_0$  = total pressure

$P$  = static pressure

$\frac{\rho V^2}{2}$  = dynamic pressure

$\rho$  = air density

$V$  = air velocity

28. In reality, the density of air is a function of pressure and as the pressure increases across the fan the density will increase, i.e., the air is compressed. Typically with fans however, the pressure rise is fairly low and the density change is considered to be insignificant, i.e., the air is considered to be incompressible.

29. The static pressure rise, rather than a total pressure rise, is typically used as the primary performance measure for the subject fans. Total pressure rise is generally used for fans that are connected directly to a duct on the inlet and/or the outlet of the fan. There is usually a difference in the area of the inlet duct to the outlet duct which results in a difference in the dynamic pressure. This difference affects the fan power consumption and must be accounted for in determining the fan performance.

30. In a fan array, the fans are generally connected to a common inlet plenum and a common outlet plenum. These plenums are typically the same size and therefore the air velocity flowing through them is the same at any point of operation. Because there is no change to the velocity from the inlet side of the fan array to the outlet side of the fan array there is no change in the dynamic pressure. Accordingly the total pressure rise and the static pressure rise are the same. As a result, it is common practice for fans of the type currently under consideration to use the static efficiency rather than a total efficiency.

31. An overall performance curve for a typical fan is shown below in Figure 6. Figure 6 includes a number of the parameters discussed thus far: static pressure, total pressure, horsepower, total efficiency, and static efficiency. Figure 6 is for a centrifugal fan with backward inclined blades.

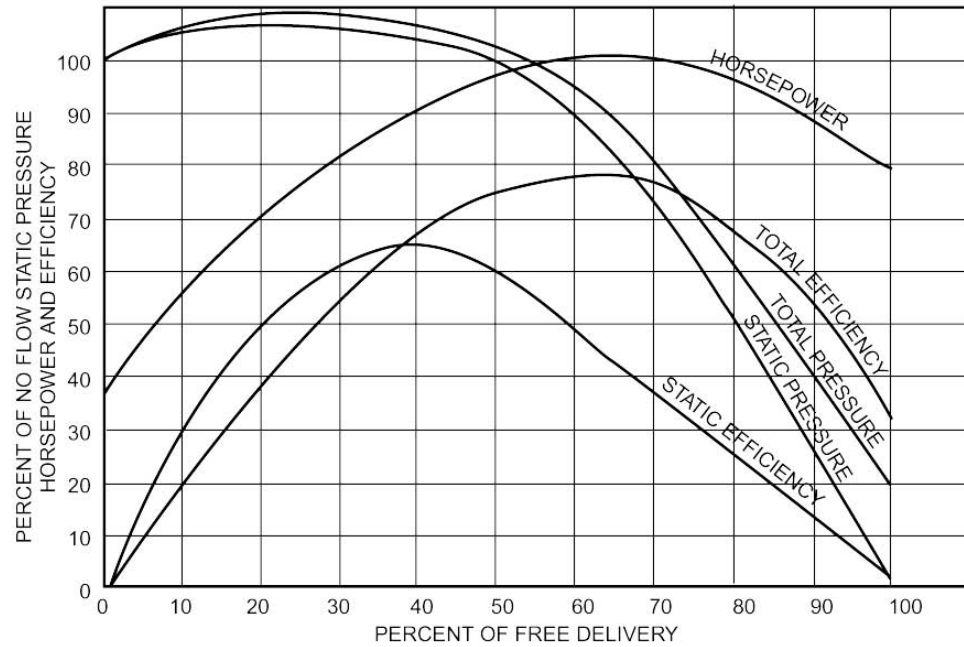


Figure 6. Fan Performance Curves for Backward Inclined Blade<sup>9</sup>

32. As illustrated in Figure 6, there will be a peak static efficiency for the fan somewhere within the overall operating range of the fan. In this case, the static efficiency peaks at approximately 38% of the free delivery flow with a peak value of approximately 65%. It should be noted that there is only a single value of flow and pressure rise at which the efficiency is a peak for a given fan speed (RPM). All of the above curves will shift when the fan speed is changed.

33. For comparison, Figure 7 shown below presents the same set of performance curves for a forward curved fan operating at a single speed.

<sup>9</sup> "Fan Performance Characteristics of Centrifugal Fans," Twin City Fan Companies, Ltd., Publication ED-2400.

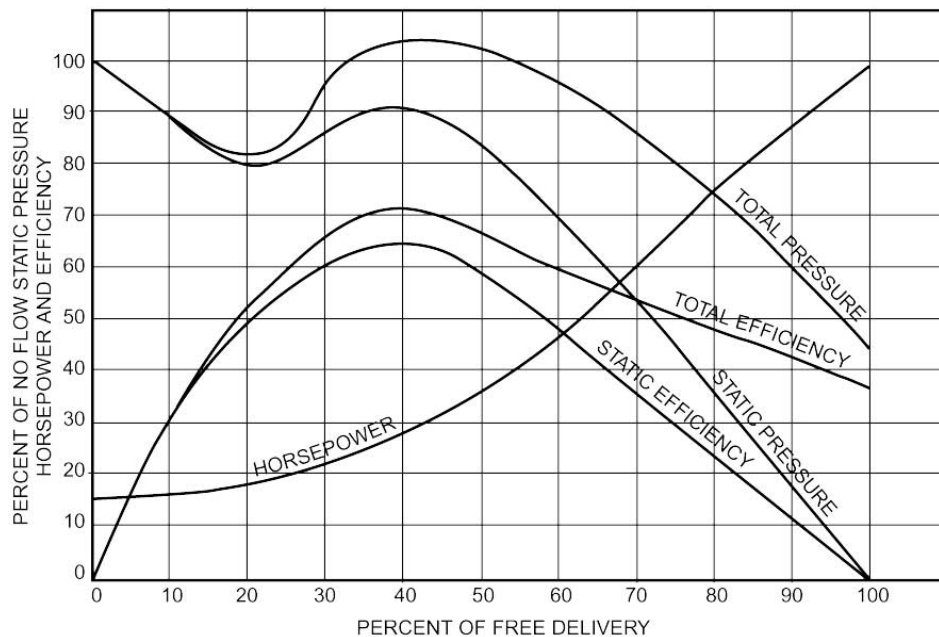


Figure 7. Fan Performance Curves for Forward Inclined Blade<sup>10</sup>

34. As in the backward inclined blade, there is a peak static efficiency for the fan within the overall operating range of the fan. In this case, the static efficiency peaks at approximately 40% of the free delivery flow with a peak value of approximately 65%. Again, it should be noted that there is only a single value of flow and pressure rise at which the efficiency is at the peak for a given fan speed (RPM). Also as noted earlier, all of the above curves will shift when the fan speed is changed.

#### F. The Surge Line

35. An extremely important consideration in the design, selection, and operation of fans is to avoid “surge.” Surge is an instability in the fans that occurs at low levels of flow and high pressure rise where the fan tends to go into stall. It is important to avoid this region of operation for the fan. A “surge line” may be defined on the fan performance curve to delineate the region of operation where surge is likely to occur. A surge line is shown below in Figure 8 on a

<sup>10</sup> Ibid.

typical fan performance plot. Shaded “surge regions” are to the left of the surge line in Figure 8 are areas

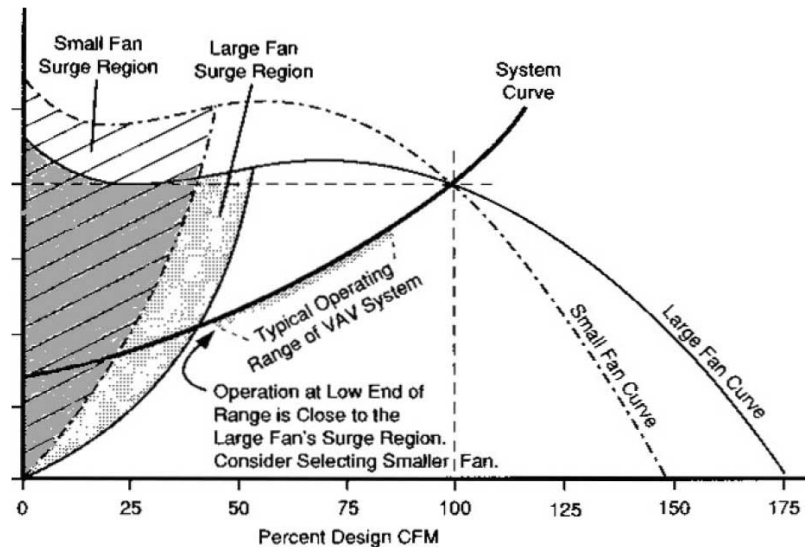


Figure 8. Surge Line<sup>11</sup>

36. In selecting fans, the designer must be careful to avoid a fan which will operate near or to the left of the surge line. Figure 8 shows how a designer might select a smaller fan to avoid operation in the surge area when the flow is controlled by a VFD that can adjust the speed of the fan. The designer generally has a choice of several fan sizes that can meet the flow and pressure requirements of the structure. Each of those fans would result in a different static efficiency and operating speed in order to achieve the desired results. It was well known by one skilled in the art, how to select fans in order to maximize the static efficiency and avoid the surge condition when the system requires lower flow than the design condition.

<sup>11</sup> M. Schaffer, “A Practical Guide to Noise and Vibration Control in HVAC systems, ASHRAE, 1991.



## VI. CLAIM CONSTRUCTION ISSUES

37. I understand that before an infringement or invalidity analysis can be completed for a patent claim, the claim must first be construed. I am told that in construing patent claims, the three principle sources of information are the patent's intrinsic evidence: the claims, the specification and the prosecution history. However, extrinsic evidence such as expert testimony, dictionaries, and learned treatises may also be relied upon. However, such evidence is less significant than the intrinsic record in determining the legally operative meaning of claim language.

38. In the following sections, I have identified key claim terms which are used in the Hopkins patents. In particular, I have considered those claim terms which require a considerable amount of technical insight to properly construe. I have attempted to provide the required technical background information in the preceding sections of this report and, in my opinion, have provided an appropriate construction consistent with the technical background.

39. Prior to discussing the specific claim terms, I have presented additional background information of particular relevance to the claim construction in the following two sections. These two sections describe two embodiments of particular significance in the Hopkins patents and information detailed in the prosecution history of the Hopkins patents.

### A. Embodiments Disclosed in the Hopkins Patents

40. As introduced earlier, the Hopkins patents are directed to an array of fans for air-handling systems. The Hopkins patents describe a number of embodiments, but these embodiments fall into two principal categories, one directed to controlling the fans to operate at peak efficiency and the other without this control.

41. As described in the specification, each of the fan units in a fan array is controlled by an array controller 300.<sup>12</sup> In one embodiment, called the "peak efficiency embodiment," the array controller 300 can be programmed to turn off certain fan units 200 and run the others at

---

<sup>12</sup> '046 patent, Col. 6, lines 20-30.

“peak efficiency.” In “an alternative” embodiment, the fan units 200 could all run at the same power level, using a VFD (variable frequency drive).

42. The “peak efficiency embodiment” is again described where “the array controller 300 is able to turn off certain fan units 200 and run the remaining fan units 200 at peak efficiency.”<sup>13</sup> This feature is described a number of times in the specification<sup>14</sup> and illustrated in Figures 13 and 14 of the patents.

43. The other embodiment, calling for a VFD to control the speed of all of the fans in the unit at once,<sup>15</sup> is the only embodiment calling for a VFD. The patent actually teaches that the “on-off” control can also act as a substitute for a VFD: “This ability to turn fans units 200 on and off could effectively eliminate the need for a variable frequency drive.”<sup>16</sup> Nowhere in the patent’s specifications is the concept of fan speed control combined with control for peak efficiency.

## **B. Prosecution History of the Hopkins Patent**

44. During prosecution of the claims of each patent, Huntair tried to get claims allowed that did not require control for peak efficiency, but was not successful. As a result, all of the claims that issued in the Hopkins patents require some control for peak efficiency.

45. Also during the prosecution of the patents in suit, Huntair made some amendments and arguments to avoid prior art. These arguments are helpful in considering what one of ordinary skill in the art would think the claim terms mean.

46. An argument of particular relevance to claim construction appears at pages 7 and 8 of an amendment dated September 8, 2006.<sup>17</sup> Here, Huntair’s patent attorney argued that then-pending Claim 15 was patentable over two references. Huntair’s patent attorney argued Claim 15 was patentable U.S. Patent No. 5,701,750 to Ray,<sup>18</sup> saying that “[c]laim 15 has been amended in substantially the same manner as claim 1 except that the control system controls the speed of

<sup>13</sup> Ibid, Col. 6, lines 64-67.

<sup>14</sup> Ibid, see e.g., Col. 7, lines 4-56, Col. 9, lines 29-39.

<sup>15</sup> Ibid, Col. 6, lines 28-30.

<sup>16</sup> Ibid, Col. 7, lines 15-17.

<sup>17</sup> CL000522-523.

<sup>18</sup> CL000939-952.

individual fans, rather than turning individual fans off, to cause the plurality of fans to run at substantially peak efficiency.”<sup>19</sup> Huntair’s patent attorney argued Claim 15 was patentable over U.S. Patent No. 4,021,213 to Niedhardt,<sup>20</sup> saying Huntair had carefully reviewed Niedhardt “and can find absolutely no teaching or suggestion of an “array controller being programmed to selectively control the speed of each of said plurality of fan units to run at substantially peak efficiency.”<sup>21</sup>

### **C. Efficiency**

47. As discussed in some detail in the preceding sections, one of ordinary skill in the art would have understood the term “efficiency” to mean “the ratio of the power delivered to the air flow to the power required to drive the fan.” For a fan array with a common inlet plenum and common outlet plenum, one of ordinary skill in the art would have further understood term to mean a “static efficiency” as opposed to a “total efficiency.”

#### **1. Peak efficiency**

48. In light of the preceding technical background, one of ordinary skill in the art would have understood the term “peak efficiency” to mean “the maximum efficiency over the range of flow rates from no flow to wide open at a given speed” where the term “efficiency” is defined as above.

#### **2. Substantially peak efficiency**

49. One of ordinary skill in the art would have understood the term “substantially peak efficiency” to suggest “an efficiency value close to the peak efficiency,” but they would not have understood how close is close enough. There is no commonly understood numerical range of “peak efficiency” one of ordinary skill in the art would have known to be “substantially peak

---

<sup>19</sup> CL000522.

<sup>20</sup> CL000772-777.

<sup>21</sup> CL 522.

efficiency.” The Hopkins patents provide no guidance whatsoever as to how close the efficiency value should be to the peak efficiency value to constitute “substantially peak efficiency.”

**D. Control, an Array Controller and Control System**

50. The terms “array controller” and “control system” are used in the specification of the Hopkins patents and in claims of the Hopkins patents. To understand the meaning of these terms, one would consider the meaning of “control” to one of ordinary skill in the art. In a most generic sense, one of ordinary skill in the art would have understood “control” to require “receiving input information, determining output information necessary to achieve a desired objective, and producing the required output information to achieve the desired objective.” In other words, “control” requires knowing what to look at and what to change to reach a desired result – it is a decision-making process requiring some kind of logic.

51. The term “array controller” is used throughout the specification of the Hopkins patents and in a number of claims of the ‘046 patent and ‘775 patents, specifically claims 1 and 16 of the ‘775 patent. The specification of the Hopkins patents teaches that the “array controller” may be a component of a control system. “A control system (that may include the array controller 300) would be used to take fan units 200 on line (an “ON” fan unit 200) and off line (an “OFF” fan unit 200) individually.”<sup>22</sup>

52. Consistent with the meaning of “control,” the specification and with the prosecution history of the patents in suit, one of ordinary skill in the art would have understood the term “array controller” to mean “an automated system to control a fan array which receives input information, determines the output information to achieve a desired objective, and produces the required output information to achieve the desired objective.”

53. The term “control system” is used in the specification of the Hopkins patents and in a number of claims of the ‘046 patent, specifically claims 1, 15, and 19. Consistent with the meaning of “control” and “array controller,” the specification and with the prosecution history of the patents in suit, one of ordinary skill in the art would have understood the term “control

---

<sup>22</sup> ‘046 patent, Col. 7, lines 12-15.

system” to be “an automated system which receives input information, determines the output information necessary to achieve a desired objective, and produces the required output information to achieve the desired objective.”

54. Once these short phrases are understood, one can then look at the longer phrases appearing in the claims of the Hopkins patents that use these phrases.

**E. a control system for operating said plurality of fan units at substantially peak efficiency by strategically turning on and off selective ones of said plurality of fan units**

55. The term “control system for operating said plurality of fan units at substantially peak efficiency by strategically turning on and off selective ones of said plurality of fan units” is used in limitation (f) of claim 1 of the ‘046 patent. Claim 1 reads as follows (emphasis added).

1. A fan array fan section in an air-handling system comprising:

- (a) an air-handling compartment;
- (b) a plurality of fan units;
- (c) said plurality of fan units arranged in a fan array;
- (d) said fan array positioned within said air-handling compartment;
- (e) said air-handling compartment associated with a structure such that said air-handling system conditions the air of said structure; and
- (f) **a control system for operating said plurality of fan units at substantially peak efficiency by strategically turning on and off selective ones of said plurality of fan units.**

56. The required “control system for operating said plurality of fan units at substantially peak efficiency by strategically turning on and off selective ones of said plurality of fan units” would generally be understood to mean something that would (a) receive input information regarding the system air flow requirements, (b) determine the output information necessary, i.e. which fans to turn on and off, and when, to achieve “substantially” peak efficiency of the fan units, and (c) produce that output information (i.e. send a signal to turn individual fans on and off) so that the fan units run at “substantially” peak efficiency.

57. Setting aside the previously mentioned problem regarding “substantially,” in my opinion, one of skill in the art would not have understood what specific control system that would do this.

58. This is because designing a control system to maximize the efficiency of fan units by turning selective ones of them on and off is extraordinarily difficult.

59. One of ordinary skill in the art would have known that for any rotational speed the fan array static pressure rise, fan array airflow, and fan array static efficiency are all related to each other by the physical characteristics of the fans selected for the array.

60. One of ordinary skill in the art would not know how to selectively turn fan units on and off to maximize the static efficiency of the fan array. In fact, the fan array is used to provide cooling or heating air to a building structure and the requirements of that structure dictate the airflow and therefore the static pressure requirement to the fan array. One of ordinary skill in the art might conclude that by turning individual fan units on and off to achieve substantially peak efficiency one would have to sacrifice control of the airflow or pressure to achieve such control. This would be counter intuitive to one with ordinary skill in the art since the function of the fan array in the building structure is to provide the proper amount of airflow in order to balance the needs of the structure.

61. The Hopkins patents provide no teaching as to what the algorithm or component is that would operate “said plurality of fan units at substantially peak efficiency by strategically turning on and off selective ones of said plurality of fan units.” The only guidance provided by the Hopkins patents is given by the following.<sup>23</sup>

“The system could turn individual fan units 200 on and off to prevent inefficient use of particular fan units 200. It should be noted that an array controller 300 could be used to control the fan units 200. As set forth above, the array controller 300 turns off certain fan units 200 and runs the remaining fan units 200 at peak efficiency.”

---

<sup>23</sup> ‘046 patent, Col. 9, lines 33-36.

62. The individual fan units 200 and the array controller 300 referenced in the above quoted section of the specification are shown below in Figure 9 which provides a reproduction of FIG. 13 of the Hopkins patents.

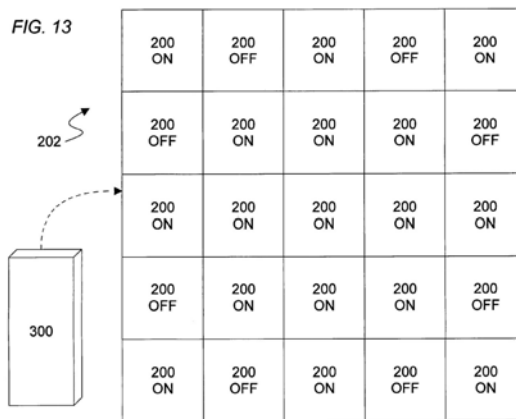


Figure 9. FIG. 13 of the Hopkins Patents

63. Other than the above quoted specification and the above drawing, the Hopkins patents provide no guidance whatsoever as to how both the volume and pressure change requirements of the system can be met by “strategically turning on and off selective ones of said plurality of fan units” and at the same time operate “said plurality of fan units at substantially peak efficiency.”

64. As introduced earlier in conjunction with the meaning of the term “control system,” there are key components to a control system, i.e., input information, a desired objective, output information, and an algorithm or method to process the information. The heart or “brain” of the control system is the algorithm (the logic). The algorithm is the method by which the input information is used or processed to arrive at the required output information to achieve the desired result. Although the Hopkins patents describe, to a very limited extent, the input information, the output information, and the desired result, there is no teaching whatsoever as to what the algorithm may be.

65. As explained in the preceding technical background sections, the relationships between the volume and pressure rise requirements of the system, the volume and pressure

performance of the fan, and the efficiency of the fan are quite complex and directly dependent upon each other. In addition, one must avoid surge conditions. One of skill in the art would have no idea based on the teaching of the Hopkins patents as to what the structure of such an algorithm might be.

**F. a control system for controlling said plurality of fan units, said control system allowing control of the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency**

66. The term “control system for controlling said plurality of fan units, said control system allowing control of the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency” is used in limitation (f) of claim 15 of the ‘046 patent. Claim 15 reads as follows (emphasis added).

15. A fan array fan section in an air-handling system comprising:

- (a) an air-handling compartment;
- (b) a plurality of fan units;
- (c) said plurality of fan units arranged in a fan array;
- (d) said fan array positioned within said air-handling compartment;
- (e) said air-handling compartment association with a structure such that the said air-handling system conditions the air of said structure; and
- (f) **a control system for controlling said plurality of fan units, said control system allowing control of the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency.**

67. The required “control system for controlling said plurality of fan units, said control system allowing control of the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency” would generally be understood to mean something that could (a) receive input information regarding the system air flow requirements, (b) determine the output information necessary, i.e. which fans to speed or slow relative to the others, and when, to achieve “substantially” peak efficiency of the fan units, and (c) produce that output information (i.e. send a signal to speed or slow individual fans) so that the fan units run at “substantially” peak efficiency.

68. Again setting aside the previously mentioned problem regarding “substantially,” in my opinion, one of skill in the art would not have understood a specific structure and logic that



could provide a control system that would allow “control of the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency.” As explained in the preceding section, one of skill in the art would have no idea based on the teaching of the Hopkins patents as to what the structure of such an algorithm might be, and would not have understood from the background of the art how to do so.

69. The file history of the ‘046 patent provides further guidance on the required construction of the term “control system” as used in claim 15. The applicant specifically stated that the control system of claim 15 must provide the capability to control the speed of individual fan units. “Claim 15 has been amended in substantially the same manner as claim 1 except that the control system controls the speed of individual fans, rather than turning individual fans off, to cause the plurality of fans to run at substantially peak efficiency.”<sup>24</sup>

70. The above section of the file history clearly indicates that some form of speed control for individual fans is required for claim 15. However, the only mention of such speed control in the specification of the Hopkins patents in the following section of the specification.<sup>25</sup>

“Another advantage of the present invention is that the array controller 300 (which may be a variable frequency drive (VFD)) used for controlling fan speed and thus flow rate and pressure, could be sized for the actual brake horsepower of the fan array fan section in the air-handling system.”

71. The Hopkins patents simply do not teach one of ordinary skill in the art a specific structure and logic would be that would allow “control of the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency.”

72. Moreover, when it comes to controlling an array of fans, whereas turning some on and off to increase overall efficiency is extraordinarily difficult, as I explained above, varying *the speed* of one fan relative to the other to increase efficiency would be extremely troublesome.

---

<sup>24</sup> File History of the ‘046 patent, p. CL000522.

<sup>25</sup> ‘046 patent, Col. 6, lines 30-34.

73. One of ordinary skill in the art would have known that for any rotational speed the fan array static pressure rise, fan array airflow, and fan array static efficiency are all related to each other by the physical characteristics of the fans selected for the array.

74. One of ordinary skill in the art would have known how to control either the static pressure rise of the fan array or the air flow of the fan array by adjusting the speed of all of the fans in unison. This is common practice in the industry when multiple fans are used in parallel. One of ordinary skill in the art would not know how to vary the speed of the individual fan units in order to maximize the static efficiency of the fan array. In fact, the fan array is used to provide cooling or heating air to a building structure and the requirements of that structure dictate the airflow and therefore the static pressure requirement to the fan array

75. One of ordinary skill in the art might conclude that by controlling the speed of the individual fan units to achieve substantially peak efficiency one would have to sacrifice control of the airflow or pressure to achieve such control. This would be counterintuitive to one with ordinary skill in the art since the function of the fan array in the building structure is to provide the proper amount of airflow in order to balance the needs of the structure.

**G. a control system for controlling the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency**

76. The term “a control system for controlling the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency” is used in limitation (f) of claim 19 of the ‘046 patent. Claim 19 reads as follows (emphasis added).

19. A fan array fan section in an air-handling system comprising:
- (a) an air-handling compartment;
  - (b) a plurality of independently controllable fan units;
  - (c) said plurality of fan units arranged in a fan array;
  - (d) said fan array positioned within said air-handling compartment;
  - (e) said air-handling compartment associated with a structure such that the said air-handling system conditions the air of said structure; and
  - (f) **a control system for controlling the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency.**

77. The required “control system for controlling the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency” would generally be understood to mean something that would (a) receive input information regarding the system air flow requirements, (b) determine the output information necessary, i.e. which fans to speed or slow relative to the others, and when, to achieve “substantially” peak efficiency of the fan units, and (c) produce that output information (i.e. send a signal to speed or slow individual fans) so that the fan units run at “substantially” peak efficiency.

78. Again setting aside the previously mentioned problem regarding “substantially,” in my opinion, one of skill in the art would not have understood a specific structure and logic that would provide a control system that would provide “controlling the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency.” As explained in the preceding section, one of skill in the art would have no idea based on the teaching of the Hopkins patents as to what the structure of such an algorithm might be, and would not have understood from the background of the art how to do so.

79. The requirement of “independently controllable fan units” and the context of the specification and file history clearly require that some form of speed control for individual fans is required for claim 19. However, the only mention of such speed control in the specification of the Hopkins patents in the following section of the specification.<sup>26</sup>

“Another advantage of the present invention is that the array controller 300 (which may be a variable frequency drive (VFD)) used for controlling fan speed and thus flow rate and pressure, could be sized for the actual brake horsepower of the fan array fan section in the air-handling system.”

80. The Hopkins patents simply do not teach one of ordinary skill in the art a specific structure and logic would be that would allow “control of the speed of the fan units in said plurality of fan units such that they run at substantially peak efficiency.”

---

<sup>26</sup> ‘046 patent, Col. 6, lines 30-34.

81. Also, as explained above, when it comes to controlling an array of fans, varying *the speed* of one fan relative to the other to increase efficiency would be extremely troublesome.

82. Therefore, one of ordinary skill in the art would not have known the structure and logic of a specific control system that would operate to control of the speed of the fan units such that they run at substantially peak efficiency.

**H. an array controller for controlling said at least six fan units to run at substantially peak efficiency by strategically turning selective ones of said at least six fan units on and off**

83. The term “array controller for controlling said at least six [plurality of] fan units to run at substantially peak efficiency by strategically turning selective ones of said at least six [plurality of] fan units on and off” is used in limitation (d) of claim 1 of the ‘775 patent and, as noted in parentheses, in claim 16 of the ‘775 patent. Claim 1 reads as follows (emphasis added).

1. A fan array fan section in an air-handling system comprising:
  - (a) at least six fan units;
  - (b) said at least six fan units arranged in a fan array;
  - (c) an air-handling compartment within which said fan array of fan units is positioned; and
  - (d) **an array controller for controlling said at least six fan units to run at substantially peak efficiency by strategically turning selective ones of said at least six fan units on and off**, wherein each fan unit has a peak efficiency operating range outside of which it operates at a reduced efficiency, and wherein said array controller is programmed to operate said at least six fan units at substantially peak efficiency by strategically turning off at least one fan unit operating at reduced efficiency and running the remaining fan units within said peak efficiency operating range.

84. The required “array controller for controlling said at least six [plurality of] fan units to run at substantially peak efficiency by strategically turning selective ones of said at least six [plurality of] fan units on and off” would generally be understood to mean something that would (a) receive input information regarding the system air flow requirements, (b) determine the output information necessary, i.e. which fans to turn on and off, and when, to achieve “substantially” peak efficiency of the fan units, and (c) produce that output information (i.e. send a signal to turn individual fans on and off) so that the fan units run at “substantially” peak efficiency.

85. Again, setting aside the previously mentioned problem regarding “substantially,” in my opinion, one of skill in the art would not have understood what a specific structure and logic would be that would control the fan units to run at substantially peak efficiency by strategically turning selective ones of the fan units on and off. As explained earlier, one of skill in the art would have no idea based on the teaching of the Hopkins patents as to what the structure of such an algorithm might be, and would not have known from the background of the art.

86. The specification of the Hopkins patents teaches that the array controller may be used to respond to variable air volume requirements for example, but fails to teach how to run the remaining fans at “substantially peak efficiency.” “In variable air volume systems, which is what most structures have, only the number of fan units 200 required to meet the demand would operate. A control system (that may include the array controller 300) would be used to take fan units 200 on line (an “ON” fan unit 200) and off line (an “OFF” fan unit 200) individually.”<sup>27</sup>

87. The Hopkins patents simply do not teach one of ordinary skill in the art a specific structure and logic would be that would allow control of “said at least six fan units to run at substantially peak efficiency by strategically turning selective ones of said at least six fan units on and off.”

---

<sup>27</sup> ‘046 patent, Col. 7, lines 9-14.

## VII. CONCLUSION

88. I reserve the right to supplement, update and/or modify this report or my testimony at trial or otherwise based on information that may later be provided to me, including but not limited to, expert reports provided by Huntair, Inc.

89. I declare under penalty of perjury that the foregoing is true and correct. Executed this 20<sup>th</sup> day of June, 2008.

By: \_\_\_\_\_



Dr. James Rice